Jan. 29, 1924. 1,482,227

C. FIELD

HEAT TRANSFERRING APPARATUS AND METHOD

Filed May 16, 1921

Fig:1.

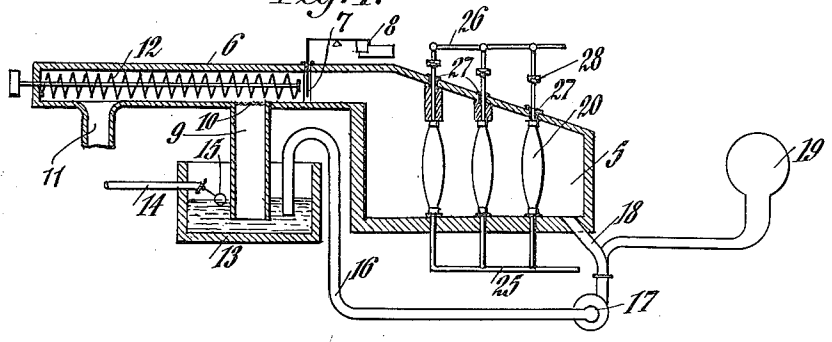


Fig:2.

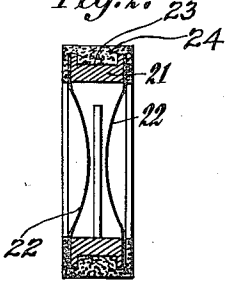


Fig:3.

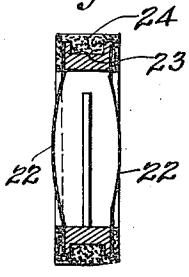


Fig:4.

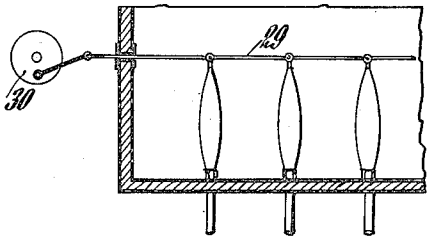


Fig:5.

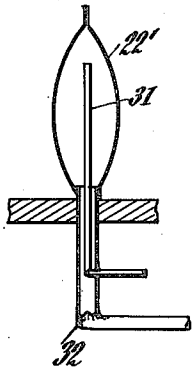


Fig:6.

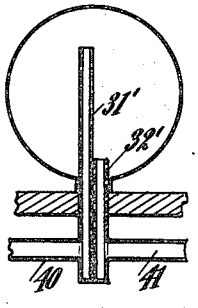
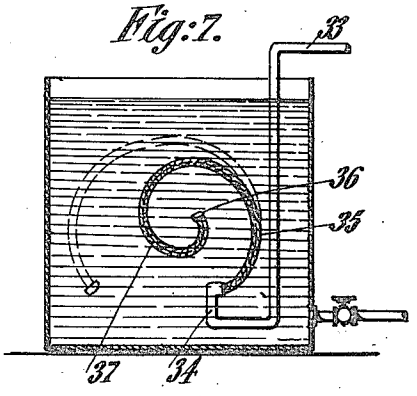


Fig:7.



INVENTOR
Crosby Field

BY C. P. Goepel

ATTORNEY

Patented Jan. 29, 1924. 1,482,227

UNITED STATES PATENT OFFICE.

CROSBY FIELD, OF YONKERS, NEW YORK.

HEAT-TRANSFERRING APPARATUS AND METHOD.

Application filed May 16, 1921. Serial No. 469,799.

To all whom it may concern:

Be it known that I, CROSBY FIELD, a citizen of the United States, and resident of the city of Yonkers, county of Westchester, and State of New York, have invented certain new and useful Improvements in Heat-Transferring Apparatus and Methods, of which the following is a specification.

This invention relates to an improved heat transferring apparatus and method, the present improvements being more particularly concerned with the provision of a simply constructed and efficiently operating apparatus for the production of mush or flake ice.

Generically considered I propose in my present invention to utilize one or more chambers arranged within a water containing tank, each of said chambers having flexible walls together with means for introducing a refrigerating agent into the chamber whereby the water in immediate contact with the outer surfaces of said walls is solidified thereon in the form of a thin ice film, and then creating variations in the internal and external pressures to thereby flex the walls of the chamber and cause the ice film to flake off therefrom.

In one embodiment of the invention I provide a mechanical means for imparting a flexing movement to the walls of the refrigerant receiving chambers which may be utilized in conjunction with the variation of the fluid pressures to more quickly and thoroughly free the ice films from the chamber walls.

It is also a further detail object of the invention to provide an improved means for introducing the refrigerating agent into the flexible chambers and for exhausting the same therefrom.

With the above and other objects in view the invention consists in the improved combination and arrangement of the several parts as will be hereinafter more fully described, illustrated in the accompanying drawings and subsequently incorporated in the subjoined claims.

In the drawings wherein I have illustrated several desirable practical embodiments of the invention and in which similar characters designate corresponding parts throughout the several views:

Figure 1 is a longitudinal sectional view illustrating one embodiment of my present invention,

Figure 2 is an enlarged sectional view through one of the refrigerant receiving chambers showing the flexible walls thereof in their normal positions,

Figure 3 is a similar view showing the chamber walls expanded.

Figure 4 is a detail section showing a slightly modified form of the apparatus,

Figure 5 is an enlarged vertical section through one of the refrigerant receiving chambers showing the means for supplying and exhausting the refrigerating agent, as employed in the apparatus illustrated in Figure 4,

Figure 6 is a view similar to Figure 5 illustrating an alternative means for supplying and exhausting the refrigerant, and

Figure 7 is a vertical sectional view illustrating a further modification of the apparatus.

Referring in detail to the drawings and more particularly to Figures 1, 2 and 3 thereof, 5 designates a tank or container which may be of any desired form and capacity. The walls of this tank are well lined with a suitable heat insulating material and the tank at its upper end is provided with a relatively narrow horizontally disposed extension 6. Adjacent to the body of the tank a valve 7 is arranged in the extension 6 to open and close communication between this extension and the interior of the tank 5. This valve is actuated by suitable time controlled mechanism conventionally represented at 8 and which operates to open and close said valve at predetermined time intervals.

Beyond the valve 7 and adjacent thereto the extension 6 is provided with a depending tube 9 the upper end of which is covered by a screen or foraminous plate 10 which permits water to freely pass into the tube 9, but obstructs the passage of solid material through said tube. The extension 6 at its outer end is provided with an outlet 11 for the solid material which is conducted to said outlet by a screw conveyor 12 mounted within the extension 6 and operated from any suitable source of power.

The water outlet tube 9 extends into a reservoir 13 which is supplied with water through the pipe 14, the water level in said reservoir being automatically controlled by the float valve 15. The intake pipe 16 of a pump 17 extends into the reservoir, the outlet pipe 18 of said pump extending up and through the bottom of the tank 5. This

pump may be of any standard type and is preferably provided with a pressure balance tank 19 containing air or other suitable gas.

Within the tank 5 one or more refrigerant receiving chambers generally designated by the numeral 20 are arranged. Each of these chambers as shown in Figures 2 and 3 consists of a metal ring 21, while the side walls of the chamber are in the form of thin flexible plates 22 preferably, though not necessarily, of metal which are securely attached in any suitable manner at their outer edges to the respective side faces of the ring 21. The free or unattached portions of these plates 22 are of appreciably greater diameter than the internal diameter of the ring. The ring 21 is provided in its outer peripheral face with a continuous groove or channel 23 and this ring is covered on its outer and side portions by the rubber, fibre or other suitable insulating material shown at 24 which has interlocking engagement with the walls of the groove 23.

The refrigerant receiving chamber as above described may be circular, elliptical or any other desired form and is preferably, though not necessarily, arranged in a vertical position in the tank 5 and is securely fixed in any suitable manner at its lower side to the bottom wall of the tank. As shown in Figure 1, the refrigerating agent is supplied to the series of chambers through the header 25 which has branch connections extending upwardly into the several chambers between the flexible side walls 22 thereof. An outlet header 26 is likewise provided with branch pipe connections communicating with the upper ends of the several chambers 20 and extending through the stuffing boxes 27 in the top wall of the chamber 5.

The operation of the above described embodiment of the invention is as follows: The tank 5 is filled with water maintained under pressure by the pump 17, it being understood that the valve 7 is closed. This external pressure on the flexible walls 22 of the chambers 20 causes said chamber walls to assume the inwardly concaved shape shown in Figure 2. The refrigerating agent is now admitted to these chambers from the supply source through header 25. Each of the connections of the outlet header 26 to these chambers is provided with an expansion valve or other control means shown at 28 through which the refrigerating agent is returned to the source of supply by reversing the direction of flow. Thus the pressure within the chambers 20 is maintained fairly constant and at less pressure than the external pressure maintained by the pump 17 in the water chamber 5. By the transference of heat through the flexible walls 22 to the refrigerating agent the water in immediate contact with the outer surfaces of said flexible walls is converted into a thin coating or film of ice. The valve 7 is now automatically opened thus reducing the water pressure in the tank or chamber 5 which becomes less than the pressure of the refrigerant in the chambers 20, whereupon the flexible walls 22 of these chambers are expanded outwardly from their concave shape, as in Figure 2, to the convex form shown in Figure 3. In this flexing movement of the walls 22, the ice film is cracked off into separate particles or flakes and being of less specific gravity than the water floats to the surface thereof. The timing mechanism 8 closing valve 7 permits the pressure to again be built up in the tank 5 so that the side walls of the chamber 20 again become concave and the cycle just described is repeated. In some operations it may be found preferable to only partially collapse the flexible walls 22. Owing to the shape of the tank 5, with each opening of the valve 7 the ice and water in proximity of said valve flows into the extension 6. The ice particles or flakes are carried by the screw conveyer 12 to the outlet 11, while the water drains through the screen 10 back to the reservoir 13 and is again returned to the tank 5.

From the above description it will be seen that the described apparatus is entirely automatic in its operation and by multiplying the number of chambers 20 mush or flake ice in any desired quantity may be rapidly produced. I have found this form of the apparatus very desirable in supplying packing ice for use in carrying out various chemical reactions. It is, however, to be understood that the apparatus may also be advantageously employed for various other purposes.

In Figure 4 of the drawings I have illustrated a slightly modified construction wherein the flexible side walls of each refrigerant receiving chamber are connected at their upper ends to a reciprocable rod 29 extending through one end wall of the water tank and which may be actuated by a suitable operating means 30 of any preferred type. In this construction, the refrigerant is admitted between the flexible side walls 22′ through the inlet pipe 31. These flexible walls are tightly joined at their edges and are fixed at their lower ends to the bottom wall of the tank. The outlet pipe 32 for the refrigerating agent communicates with the space between the walls 22′ at the lower ends thereof, the inlet pipe 31 which is of relatively small diameter extending through this outlet pipe which returns the refrigerant to the source of supply. In this construction the refrigerant receiving chambers are preferably circular in form, and the side walls of the chambers are flexed by variations in the internal and external pressures in the manner above de-

scribed. Therefore, it will be understood that if desired the reciprocating rod 29 connected to the upper ends of the walls 22′ need not be employed. However, in order to expedite the separation of the ice film from the surface of the walls 22′, I may use this means for imparting a bodily flexing movement to the chambers which result in a peeling action, causing the ice to separate from the flexible walls in somewhat larger particles.

In Figure 6 of the drawings I have illustrated another means for supplying and exhausting the refrigerant wherein the inlet pipe 31′ and the outlet pipe 32′ are arranged in parallel relation alongside of each other, the inlet pipe extending upwardly above the outlet pipe between the flexible side walls of the refrigerant receiving chamber. The lower ends of these pipes are closed and respectively communicate with the refrigerant supply pipe 40 and the return pipe 41.

Referring now to Figure 7 of the drawings wherein I have illustrated another alternative embodiment of the invention, the refrigerant supply pipe 33 extends downwardly into the water containing tank and has its lower end upwardly turned as at 34. To this end of the supply pipe there is suitably secured a flexible tube 35, the free end of which is provided with a suitable closure 36. A coil spring 37 may be enclosed within this tube or may externally surround the same. This spring acts to normally maintain the flexible tube in the coiled form shown in full lines in Figure 7, though if desired the tube may be of such inherent elasticity that it will normally maintain this coiled condition. Upon the admission of the brine, freezing gas or other refrigerant to the tube 35, a coating or film of ice will form upon the exterior surface of said tube. By then increasing the pressure of the refrigerating agent within the tube, said tube is uncoiled or moved towards a straight line position, as shown in dotted lines in Figure 7. In the flexing of the tube walls incident to this uncoiling movement, the ice film is cracked or broken and thereby caused to separate from the surfaces of the tube so that it will float to the surface of the water contained in the tank from which it may be removed by means of a suitable conveyor.

From the foregoing description, considered in connection with the accompanying drawings, the construction and manner of operation of the several described embodiments of the invention will be clearly understood. In each of the constructions referred to the apparatus is relatively simple and provides an efficient and serviceable means for producing mush or flake ice in large quantities. While I have specifically referred to several constructions which I believe best exemplify the principle involved, it will, nevertheless, be understood that the apparatus might also be constructed in various other alternative forms and I accordingly reserve the privilege of adopting all such legitimate changes in the form, proportion and relative arrangement of the several parts as may be fairly embodied within the spirit and scope of the invention as claimed.

I claim:

1. In a heat transferring apparatus, a fluid receiving tank, means within said tank to receive a heat conducting fluid and having a flexible heat transferring wall upon the surface of which the fluid in the tank in immediate contact with said wall is solidified by heat transference, and means for creating pressure differences of the fluids on opposite sides of said wall to thereby flex the wall and cause a separation of the solid deposit therefrom.

2. In a heat transferring apparatus, a fluid receiving tank, a refrigerant receiving chamber within said tank having flexible side walls, means for continuously circulating the refrigerant through said chamber whereby the fluid in the tank in immediate contact with the outer surfaces of said chamber walls is solidified by heat transference and means for creating pressure differences of the fluid in the tank and a refrigerating agent within said chamber to thereby flex the walls of the chamber and cause a separation of the solidified deposit therefrom.

3. In a heat transferring apparatus, a fluid receiving tank, means for supplying a fluid to be treated under pressure to said tank, a plurality of chambers arranged within said tank, each chamber having flexible side walls, means for continuously circulating a heat conducting medium through said chambers whereby the fluid in immediate contact with the surfaces of the chamber walls is solidified by heat transference and means for creating pressure differences of the heat conducting medium within said chambers and of the fluid within the tank to thereby flex the walls of said chambers and cause a separation of the solidified deposit therefrom.

4. In a heat transferring apparatus, a fluid receiving tank having an outlet, means for supplying the fluid to be treated under pressure to said tank, a time controlled valve for opening and closing the outlet at predetermined intervals to thereby regulate the fluid pressure within the tank, a plurality of chambers within said tank each having flexible side walls, means for continuously circulating a heat conducting medium through said chambers to solidify the fluid in the tank in immediate contact with the chamber walls by heat transference, the opening of said valve creating a differ-

ence in pressure between the fluid in the tank and the heat conducting medium in said chambers to thereby flex the walls of said chambers and cause the separation of the solidified deposit therefrom.

5. In a heat transferring apparatus, a fluid-receiving tank, a chamber arranged within said tank and having a flexible heat transferring wall, means for supplying a heat transferring medium under pressure to said chamber, means for supplying the fluid to be treated under pressure to said tank, and means for varying the pressure of the fluid in the tank with respect to the pressure of the heat transferring medium in said chamber to thereby cause the flexure of said chamber wall and effect a separation of the solidified deposit therefrom.

6. The method of recovering solids from fluids by heat transference which consists in contacting a heat conducting medium with one side of a flexible heat transferring wall and contacting the fluid to be treated against the opposite side of said wall whereby the fluid is solidified in the form of a film upon the surface of the wall by heat transference, and creating differences in pressure of the fluid being treated and of the heat conducting fluid to thereby cause a flexure of said wall and effect a separation of the film of solid therefrom.

7. In a crystallizing receptacle, spaced walls made of sheets of flexible and impermeable material for receiving the crystals, means for maintaining the fluid being treated under pressure in contact with the outer surfaces of said walls to normally flex said walls in one direction and means for supplying a heat transferring medium under pressure to the space between said walls for flexing said walls in an opposite direction and thereby cause the separation of the solidified deposit therefrom.

In testimony that I claim the foregoing as my invention, I have signed my name hereunder.

CROSBY FIELD.